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Determining Relative Weights of Inflation Uncertainty in Turkey via CPI and Its Components

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ABSTRACT

This study aims to investigate the interaction of main expenditures groups of CPI with the fluctuations taking place at the level of general prices and calculate the relative weights of theirs uncertainties within inflation uncertainty. Since there might be structural breaks in the investigated variables, Bai-Perron test, GARCH-type models are constructed by including the breaks in the fluctuation measurement and ARDL approach has been used to determine the long-term relationship between the variables. Contrary to expectations, it was revealed that the expenditure group having the greatest impact on inflation uncertainty is not "food, beverage and tobacco" expenditure group but "transportation".

Keywords: *GARCH-type models with multiple structural breaks, Bai-Perron method, Inflation uncertainty, main expenditure group uncertainties, ARDL method*

1. INTRODUCTION

The desire to account for the price fluctuations experienced in economies has been one of the most important goals of almost all economic approaches. Though there are some downward changes in these price fluctuations, prices generally show tendency to increase particularly in underdeveloped and developing countries and this has made inflation an important phenomenon. Because of many different reasons (structural, political, and conjectural), changes are observed in many macroeconomic indicators such as inflation. Even in economies that are similar on economic ground, macroeconomic indicators may show variation depending on their own dynamics. Therefore, it is clear that variation is an indispensible economic reality and it is almost impossible to get rid of it. As the variation in inflation stems from its own dynamics, there is no possibility of intervening with the occurring changes; yet, it is possible to reduce uncertainty.

Furthermore, forecasting, estimating and managing multi-faceted and profound effects that can be created by price increases are of great concern to both macro and micro units. Without doubt, first and most important step in the management of uncertainty is the determination of the level of the uncertainty; that is, measurement of the uncertainty.

In Turkey, as the general level of prices, Consumer Price Index (CPI) is used and inflation is calculated on the basis of the value changes in this index. Therefore, CPI was used for the analysis of inflation uncertainty in the present study that has focused on the main expenditure groups of CPI. Furthermore, in the analysis of inflation uncertainty between 1994:01 and 2013:12,

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besides the data related to the general index, the data about 10 different expenditure groups; "Food, Beverage and Tobacco", "Clothing and Footwear", "Housing, Water, Electricity and Gas", "Health", "Transportation", "Recreation and Culture", "Education", "Hotels, Cafes, and Restaurants" and "Miscellaneous Goods and Services" were used as representative of CPI data with based year of 1994. As inflation is a value found through the combination of these expenditure groups, it can be argued that inflation uncertainty is the function of uncertainties experienced in these groups.

While examining these sub-indices, it was seen that the expenditure groups having the greatest average weight in the inflation basket of the period under investigation are respectively "food, beverage and tobacco", "housing" and transportation". Thus, the main hypothesis of the study requires the investigation of whether the relative weights of the fluctuations caused by the main expenditure groups on inflation uncertainty are congruent with the weights of main expenditure groups on the index. *In this regard, the current study is the first study conducted to determine the relative weights of main expenditures group uncertainties within inflation uncertainty and believed to be of great importance to help fill this void by exploring the interaction between the components of CPI and fluctuations occurring in general price levels.*

Methodologically, since there can be structural changes within the investigated variables, volatility forecast models are constructed and estimated by including their dates of break. While conducting structural break studies in the series, in inflation and all of the main expenditure groups inflation series, one or more than one break was detected in different dates.

At the same time, cointegration relationship between inflation uncertainty and its own components' uncertainties were investigated by means of Autoregressive Distributed Lag (ARDL) and the obtained uncertainty series were observed to be interrelated and move together. Then, using the obtained standardized uncertainty series in the long run equation, the relative weight of the main expenditure groups within inflation uncertainty was determined. Contrary to expectations of money authorities in Turkey, it was revealed that the expenditure group having the greatest impact on inflation uncertainty is not the uncertainty within "food, beverage and tobacco" group but the uncertainty within "transportation" expenditure group.

2. LITERATURE REVIEW

Considered to be the measurement of a deviation of a random variable from its mean from statistical point of view, "volatility"; for example, for inflation from economics point of view represents fluctuations or instability (Omotosho ve Daguwa, 2013). Thus, Banerjee (2013) defines inflation volatility as the measurement of the severity of the unexpected changes in inflation and unforeseen components of inflation stemming from recurring external shocks in the series.

On the other hand, as uncertainty stems from the difficulty of estimating the future values of the variable under investigation, it means inability of predicting the likelihood of future incidences (Grier ve Perry, 1998). In this connection, inflation uncertainty can be roughly defined as unpredictability of the future price level. Here, unpredictability means uncertainty in forecasting. It also represents the spread of forecast or the extent of uncertainty (Tsyplakov, 2010).

The research on the concept of inflation having a long and rich history has focused on three basic features of inflation dynamics that are level of inflation, permanence of inflation and variability of inflation. While there is a great amount of research on the first two features of inflation, there is a limited amount of research on variability of inflation, particularly in developing countries (Banerjee, 2013). The first argument of possible correlation between inflation and its uncertainty, has a long and well-known history. (See for example, Friedman, 1977; Ball, 1992; Cukierman-Meltzer, 1986, Pourgerami-Maskus, 1987 and Holland 1995). There is an extensive literature of studies addressing this relationship from many different perspectives.

The research aiming to determine the best representative of inflation uncertainty that is the second important stage of the discussions in the literature focuses on the measurement of uncertainty. On the other hand, as inflation uncertainty is not a directly observable variable, many econometric methods have been proposed to forecast uncertainty.

As Engle (1982) proposed the ARCH model for determining volatility, it has become a powerful method for the analysis of economies and financial markets of all the other developed countries and many researchers have employed GARCH-type models to test inflation uncertainty (Bollerslev, 2007). Therefore, they have become the basis of dynamic modeling. Moreover, in addition their practicality in forecasting, they allow the application of diagnostic tests (Drakos et al. (2010).

Therefore, inflation uncertainty is generally expressed as conditional volatility obtained from GARCH models (Zapodeanu et al., 2013) and ARCH models are preferred in the literature more than standard heteroscedasticity (nonconstant variance) methods calculated as the moving average of error squares. Similarly, when the other studies dealing with the situation in Turkey are examined, it is seen that mostly ARCH and GARCH methods are used to obtain inflation uncertainty.

3. MATERIALS AND METHODS

3.1. Volatility Forecasting Models with Structural Break

Revelation some weakness of standart unit root tests in applications has led to the development of tests considering potential structural breaks in time series. One of these determination methods is called Bai-Perron (BP) structural break test. It was introduced to the literature by Bai (1997) and Bai and Perron (1998,

2003a, 2003b and 2004) and has many advantages compared to other tests (See for example, Endresz, 2004; Enders and Sandler, 2005; Antoshin, Berg and Souto, 2008).

As also it is known, univariate GARCH models consist of two different equations. The first is called the mean equation describing the data observed as the function of the other variables and error term. The second one is the variance equation indicating the variation of the conditional variance of errors from the mean equation as the function of the past conditional variance and lagged error terms (Hentschel, 1995). Therefore, first it should be checked whether there exists any break in mean parameters (intercept and/or slope) and then if there is, in the variance. As known, it would also be possible to observe changes in variance if breaks in mean were detected. With the incorporation of breaks into mean and variance equations, transition to GARCH forecasting models will be realized.

In this context, the models have been converted to mean and variance model with structural breaks as in the following Equations 1 to 3:

$$y_t = \mu + \sum_{i=1}^{n} \mu_i D_i + \sum_{i=1}^{n+1} \emptyset_i D_i y_{t-1} + u_t \quad (1)$$

Since the "number of breaks" is n, D_i takes the value "1" for the break occurs in mean between ith and (i-1)th break. The series becomes D_i=0, out of the location space indicated in the series and $k_{mean,0}$ =1. Whereas the parameter $\emptyset_i$ represents the slope of each period between sequential two breaks, μ_i gives the deviation from the mean between ith sub-period and n+1th period (Endresz, 2004; Pelipas, 2012).

After that the determination of the number of breaks of the mean of the variance (m) and their locations (k_{var}), for illustration, one of the GARCH-type models GARCH(1,1) model is obtained with mean equation as follows (Endresz, 2004).

$$u_t^2 = v + \sum_{i=1}^{m} v_i D_i \quad (2)$$

$$h_t^2 = \alpha_0 + \sum_{j=1}^{m} \alpha_{0,j} D_j + \alpha_1 u_{t-1}^2 + \beta h_{t-1}^2 \quad (3)$$

$$u_t = \varepsilon_t h_t \quad (4)$$

Where u_t^2 are the square of the residuals obtained from the mean equation, ε_t has standart normal distribution and D_i being the dummy variable takes the value of D_i=1 for $k_{var,i-1} \leq t < k_{var,i}$ and when $v_i = 0$ (no break) the null hypothesis is rejected, there will be m number of breaks.

3.2. Investigating Long-Term Relationship With Autoregressive Distributed Lag (ARDL) Method

The structure of the relationship between time series can be investigated through co-integration tests (Engle-Granger, 1987; Phillips and Hansen, 1990; Johansen, 1988; 1991; 1995 and Johansen-Juselius,1990) that require the constraints of integration of the same order for instance I(1). Yet, when multiple variables are involved, mostly all of the investigated series are not I(0) or I(1) simultaneously, and they even display different degrees of co-integration. In order to come up with solutions to such problems encountered in applications, Pesaran and Shin (1998) and Pesaran et al. (2001) proposed ARDL approach based on OLS and it has become quite popular in addressing the issue of cointegration in recent years. Moreover, ARDL modeling has many advantages compared to other co-integration tests (See for example, Pesaran, Shin and Smith, 1999; Laurenceson and Chai 2003; Narayan and Narayan, 2005; Frimpong and Oteng-Abayie, 2006; Shahbaz, Adnan ve Kumar, 2012; Banerjee and Rahman, 2012).

As it is already known ARDL method works with two stages. In the first stage whether there is a long run relationship between the investigated variables has been researched. If there exists an evidence of co-integration between the variables under investigation, in the next stage it is possible to model and estimate both the long run and short run coefficients.

4. EMPIRICAL ANALYSIS

4.1 Data

In inflation modeling, one may wonder which inflation measurement should be used. First, the inflation measurement to be utilized in the determination of the extent of inflationist pressure on the economy, it must possess some basic characteristics. In this regard, much of the literature focuses on Consumer Price Index (CPI) as the index and rather than its disadvantages such as its content and calculation, it focuses on its advantages. Its main advantages are that it is the only scalar proposed to reveal a general overview of multi-dimensional price movements (Larsen, 2004), it can be used faster than the other indicators by the state, it is known well among the public, it is easy to calculate and it has a long history, it can show the effects of price changes on living standards, it is frequently revised and it can be measured monthly with small intervals (Petursson, 2000). Moreover, it is less sensitive to the manipulations of central banks and this increases its reliability and there is no better alternative to CPI as it is the existing best and the most up-to-date price index (Carare, et al. 2002).

It also provides some other advantages such as making comparisons in the international literature using primarily CPI as a dependent variable (Norman ve Richards, 2012). Moreover, as it interests consumers representing the majority of economic units, Mankiw (2006) pointed out that CPI is used to measure inflation in majority of studies. In Turkey, as the general level of prices, CPI is used and inflation is calculated over the changes in this index. Central Bank of Republic of Turkey-(CBRT) (2006) stated that as perceived in all

over the world, the best measurement in terms of scope, calculation method and representation value is CPI. Furthermore, by considering the reasons such as the use of CPI in most of the inflation targeting regimes, in the present study, with the base year of 1994 monthly Consumer Price Index data set covering 1994:01-2013:12 period was used. The data set obtained from the official web site of The Turkish Statistical Institute (TUIK). Inflation series are obtained through the differentiation of monthly indexes. For the easiness of display, if not the opposite is stated, CPI will be used as "inflation" and main expenditure groups will be shown with the following abbreviations: "FBT_INF", "CAF_INF", "HWEG_INF", "FHE_INF", "H_INF", "T_INF", "RAC_INF", "HAR_INF", "E_INF" and "MGS_INF".

4.2 Descriptive Statistics and Stationarity Detection

The descriptive statistics belonging to the variables involved in the study are presented in Table 1 and evaluate from statistical and economic point of view. It is seen that monthly mean inflation for the period of 1994:01-2013:12 is in the range of 2-2.5% and the main expenditure groups having the highest monthly mean inflation are housing (2.54%), restaurants (2.5%) and transportation (2.47%) and the main expenditure groups having the lowest monthly mean inflation are recreation (2.13%), furnishings (2.14%) and clothing (2.15%). The positiveness of the mean of the series indicates that there was a general tendency of increase in each of these expenditure groups in the period under investigation.

Table 1: Descriptive Statistics of Both the Inflation and Its Main Expenditure Groups

Statistics	INFLATIO	FBT_INF	CAF_INF	HWEG_INF	FHE_INF	H_INF	T_INF	RAC_I	E_INF	HAR_IN	MGS_INF
Mean	0,0240	0,0241	0,0215	0,0254	0,0214	0,0223	0,0247	0,0213	0,0245	0,0250	0,0226
Median	0,0171	0,0165	0,0110	0,0186	0,0133	0,0058	0,0161	0,0119	0,0010	0,0149	0,0133
Maximum	0,2101	0,2599	0,1995	0,1179	0,1840	0,2091	0,3396	0,2034	0,6011	0,1931	0,2785
Minimum	-0,0144	-0,0554	-0,1078	-0,0193	-0,0234	-0,0107	-0,0254	-0,0332	-0,0120	0,0020	-0,0240
S.Dev.	0,0254	0,0348	0,0618	0,0228	0,0259	0,0369	0,0339	0,0301	0,0810	0,0236	0,0353
Skewness	2,1484	1,6229	0,3232	0,8673	1,9361	2,5289	4,0853	2,0464	4,6640	2,2403	3,6107
Kurtosis	13,807	10,705	2,404	3,505	10,445	10,041	34,143	9,801	25,906	12,916	20,925
JB	1346,9	696,0	7,7	32,5	701,3	748,5	10323,1	627,4	6091,4	1179,1	3719,0
Prob.	0,0000	0,0000	0,0213	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000

When the standard deviation values that can give some insights into the volatility of the variables are examined, education (8.1%) and clothing (6.2%) come to the fore and except for housing and restaurants, all the groups have standard deviations quite higher than the mean. Based on the highness of this value showing the distribution of the series in relation to the mean, it is possible to claim that many values are higher than the mean value of all the series depending on a distribution quite far away from the means of all the series. At the same time, this may indicate that the series are under the influence of volatility. In a similar manner, the size of the difference between the minimum and maximum values of all the main expenditure groups supports the finding that price changes have high volatility. When the skewness values are examined, it is seen due to fact that positivity of skewness distribution of all the main expenditure groups are skewed towards right. This shows that unusual large shocks occurring in the series are more pervasive than small shocks and positive price changes are more likely than negative price changes. Moreover, lower median values than the means indicates the rightward skewness of the series. Jarque-Bera statistics do not confirm normal distribution of any series.

On the basis of all this information, in order to reveal whether the variables under investigation are stationary or not, ADF, PP and KPSS unit root test was conducted and the results are presented in Appendix 1. It is seen that those unit root tests have revealed different results from each other. As the obtained conflicting results indicate that there may be break in the series, whether any structural changes occurred in the inflation series in the period under investigation needs to be researched.

4.3. Conditional Volatility Estimates in Inflation and the Main Expenditure Groups Inflation Series With Structural Break At Mean and Mean of Variance Equation

At that stage, BP method was employed to detect whether there are structural breaks in the mean and variance equation of inflation series. While conducting the application, as there might be heterogeneity in the error, the standard correction parameter was taken as 0.15 and the maximum number of breaks is allowed to be no more than 5 (Bai Perron, 2003a). While determining its location through the number of breaks, sequential testing was preferred and the results are presented in Table 2.

Table 2: The Results of Bai-Perron Structural Break Test for Inflation and the Main Expenditure Groups Inflation Series Breaks in Mean and Mean of Variance Equation

Mean			Variance		
Series	Number of Breaks	Break Dates	Series	Number of Breaks	Break Dates
INFLATION	1	2002:M02	INFLATION	1	2001:M06
FBT_INF	1	2003:M04	FBT_INF	1	2002:M06
CAF_INF	2	2003:M08-2007:M12	CAF_INF	-	-
HWEG_INF	1	2000:M01	HWEG_INF	-	-
FHE_INF	1	2001:M06	FHE_INF	-	-
H_INF	1	2000:M03	H_INF	1	1998:M08
T_INF	1	2001:M05	T_INF	1	2002:M03
RAC_IN	1	1998:M10	RAC_IN	2	2001:M12-2010:M02
E_INF	1	1998:M01	E_INF	-	-
HAR_INF	1	2003:M03	HAR_INF	1	2001:M05
MGS_INF	1	2002:M02	MGS_INF	-	-

It is known that the Turkish economy has been deeply affected from crises, internal dynamics, conjectural changes in the world and has undergone many structural changes. This is clear in Tab. 2, which shows at least one break experienced in mean by all the indicators. Moreover, graphical representation of these breaks was displayed in Figure 1. For a variable experiencing breaks in its mean, it is usual to experience breaks in its error variance. In addition to this, not each inflation series experiencing a break in its mean experienced a break in the variance, only in the error variance of inflation and 5 different main expenditure groups, breaks were detected.

When the developments that may have changed the structure of the series are examined, the date 2001 is seen to be a turning point in terms of the implementation of monetary and fiscal policies. Moreover, these break periods indicate years considered to be turning points of the Turkish economy and some crisis periods. This finding supports that in Turkey, price changes have undergone important transformation and this mostly happened in crisis periods. These detected breaks need to be taken into consideration in volatility forecasts for inflation series.

In this first stage, the displays of the mean equations with the breaks are presented in Appendix 2 including seasonal term in order to remove the seasonality effect. Furthermore, whether the errors of these mean equations are under the influence of stationarity and/or ARCH effect was investigated and the obtained results are presented in Appendix 3. As a result of the autocorrelation test administered, it was found that though all the residuals are stationary, they are under the influence of ARCH.

In the second stage, for each main expenditure group inflation, model searching was performed over all the uncertainty series obtained through ARCH, GARCH, EGARCH and TGARCH volatility forecasting models satisfying the model requirements. Thus, the main expenditure group volatility forecasts explaining inflation uncertainty in the modeling were preferred and the models having these characteristics are presented in Table 3 and their graphical display is presented in Figure 2.

In addition, in the suitable lag length of ARCH-LM test of all the models, it is seen that there is no ARCH effect remained in the residuals. This confirms that the models best filter the ARCH effect in the series and reflect in its own model. Furthermore, as a result of autocorrelation tests, stationarity of model residuals was detected and this clearly demonstrates the suitability of the models.

Table 3: The Most Representative Uncertainty Models Detected for Inflation and the Main Expenditure Groups Inflation Series

Variables	ARCH-LM(1)	Stationarity of Residuals(2)	Selected Model
INFLATION	0.212247 (0.6454)	Stationary	EGARCH(1,1)
FBT_INF	12.15273 (0.1445)	Stationary	EGARCH(1,0)
CAF_INF	2.782834 (0.7334)	Stationary	GARCH (1,1)
HWEG_INF	0.818772 (0.3655)	Stationary	EGARCH (2,0)
FHE_INF	2.876571 (0.0899)	Stationary	EGARCH (2,5)
H_INF	0.194895 (0.6589)	Stationary	EGARCH(2,5)
T_INF	0.048214 (0.9762)	Stationary	EGARCH(1,0)
RAC_INF	0.428466 (0.9997)	Stationary	EGARCH (1,5)
E_INF	2.876227 (0.7191)	Stationary	EGARCH (0,6)
HAR_INF	9.125361 (0.1666)	Stationary	EGARCH (5,3)

MGS_INF	0.055199 (0.8143)	Stationary	EGARCH (4,5)

(1) *Values between brackets represent the significant p level.*

(2) *Stationarity of selected the model residuals has been diagnosed using ADF, PP and KPSS unit root tests with 5% significance level.*

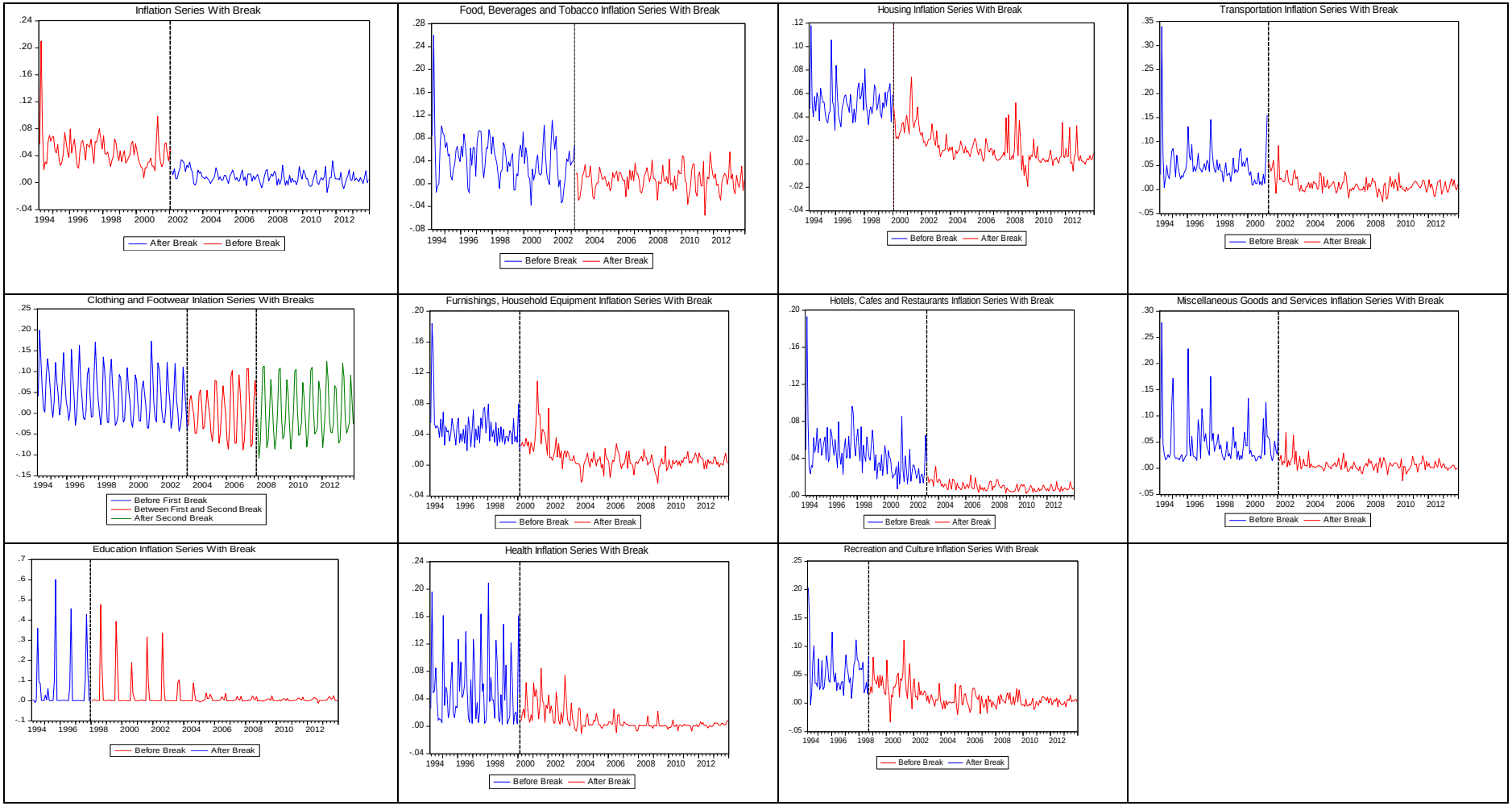


Figure 1: The Graphical Representations For Each Main Expenditure Group with Specification of Break Points.

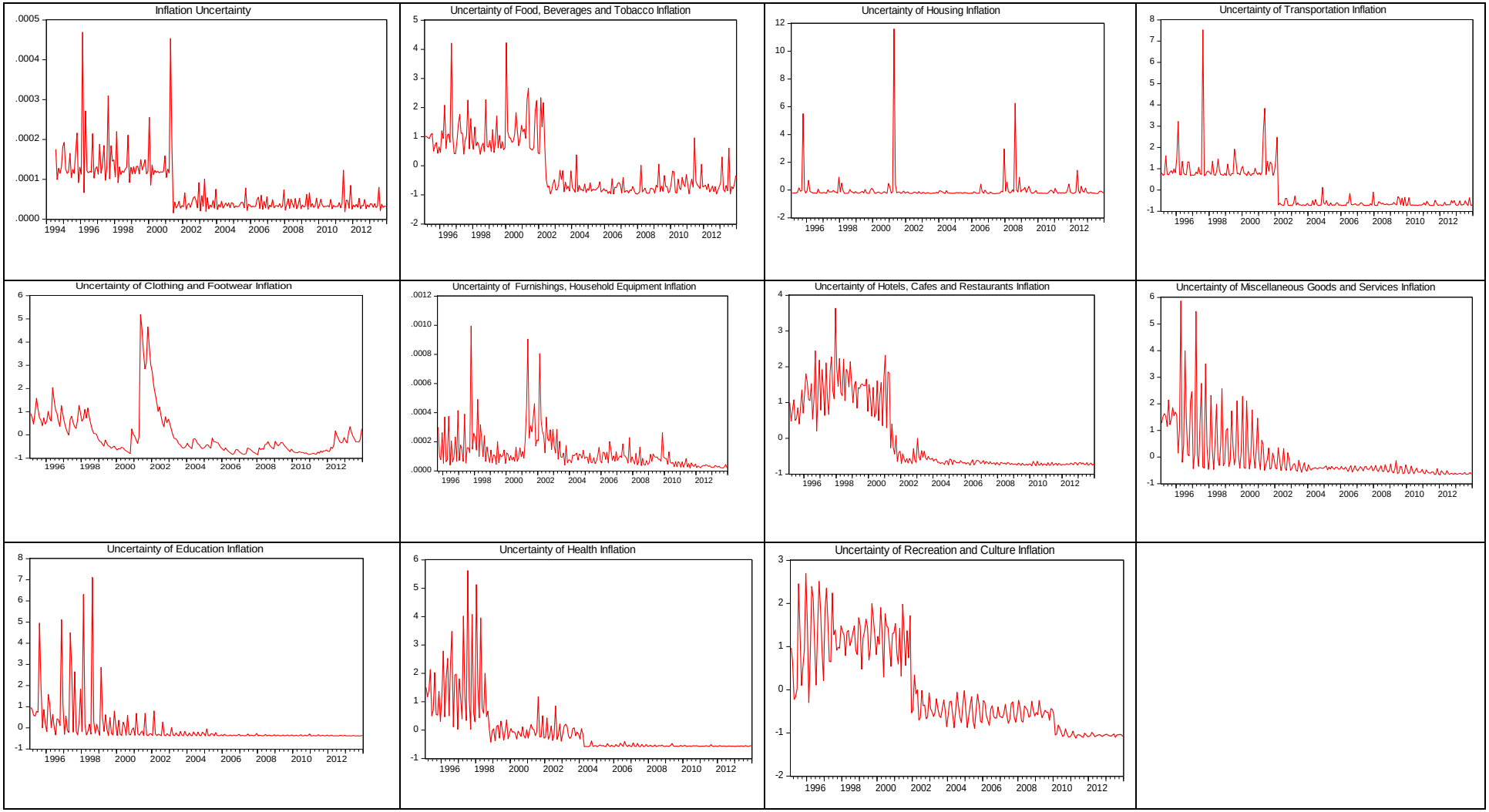


Figure 2: Graphical Representations of Inflation Uncertainty and Uncertainty of Each Main Expenditure Groups Series

4.5. Determining Relative Importance of Main Expenditure Groups Uncertainties on Inflation Uncertainty

In the current study, inflation uncertainty series and 10 main expenditure groups uncertainties series were used as the dependent variable being Y_t and the independent variables being $X_1, X_2, \ldots\ldots, X_{10}$ obtained using volatility forecasting models with structural break. Their names and definitions are presented in Appendix 4 and graphical display of plotting of inflation uncertainty with the uncertainty for each of the main expenditure groups is presented in Figure 3. ARDL approach is also explained considering the number of these variables to preserve the integrity of information. As inflation is a value found through the combination of these expenditure groups, it can be argued that inflation uncertainty is the function of uncertainties experienced in these groups. In order to reveal the uncertainty of the main expenditure groups having the greatest effect on the inflation uncertainty in the long run;

$$Y = f(X1_t, X2_t, X3_t, X4_t, X5_t, X6_t, X7_t, X8_t, X9_t, X10_t) \quad (5)$$

Econometric display of the model can be expressed as below;

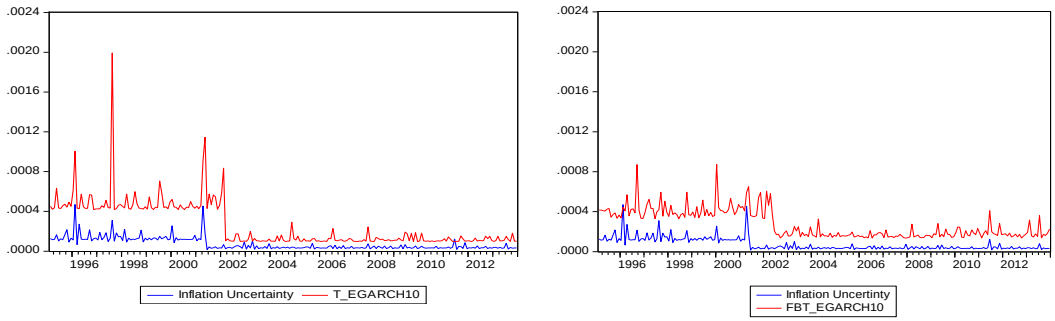
$$Y_t = \gamma_0 + \gamma_1 X1_t + \gamma_2 X2_t + \gamma_3 X3_t + \gamma_4 X4_t + \gamma_5 X5_t + \gamma_6 X6_t + \gamma_7 X7_t + \gamma_8 X8_t + \gamma_9 X9_t + \gamma_{10} X10_t + \varepsilon_t \quad (6)$$

When the series are in a co-integration relationship, the long run relationship between the variables can be revealed through the co-integration model obtained without administering differentiation accordingly without loss of any information. The long run coefficients at the same time show the weights of the uncertainties belonging to the main expenditure groups' inflations within the inflation uncertainty here.

However, for the order of importance (relative weights) of the variables involved in the co-integration equation showing that the series act simultaneously, all the variables in the regression (dependent and independent) should be standardized and then the regression should be reestimated with the standardized variables.

As known, it is very simple to evaluate the relative importance of two independent variables measured with the same units on the y dependent variable. In the comparisons made, the one whose absolute regression coefficient is higher is considered to be more important. However, in practice and applications, the measurement units of the explanatory variables are not the same and this makes it difficult to determine the relative weight order of the explanatory variables with ordinary regression coefficients. In order to deal with this problem, the variables are standardized and moved to the same unit measurement.

In this regard, the obtained standardized coefficients allow us make comparisons among the relative impacts of the independent variables on the dependent variable (Y) without relying on measurement units. They also provide the relative weights of each explanatory variable; namely, their partial contributions to unit change taking place in the dependent variable. At the same time, by using standardized coefficients, the contribution of each variable can be compared with the contributions of the other variables (Greene and D'Olivera, 2005). Therefore, in the current study, the co-integration equation was estimated over the standardized variables and the main expenditure group uncertainty having the greatest effect on inflation uncertainty was calculated with this method.



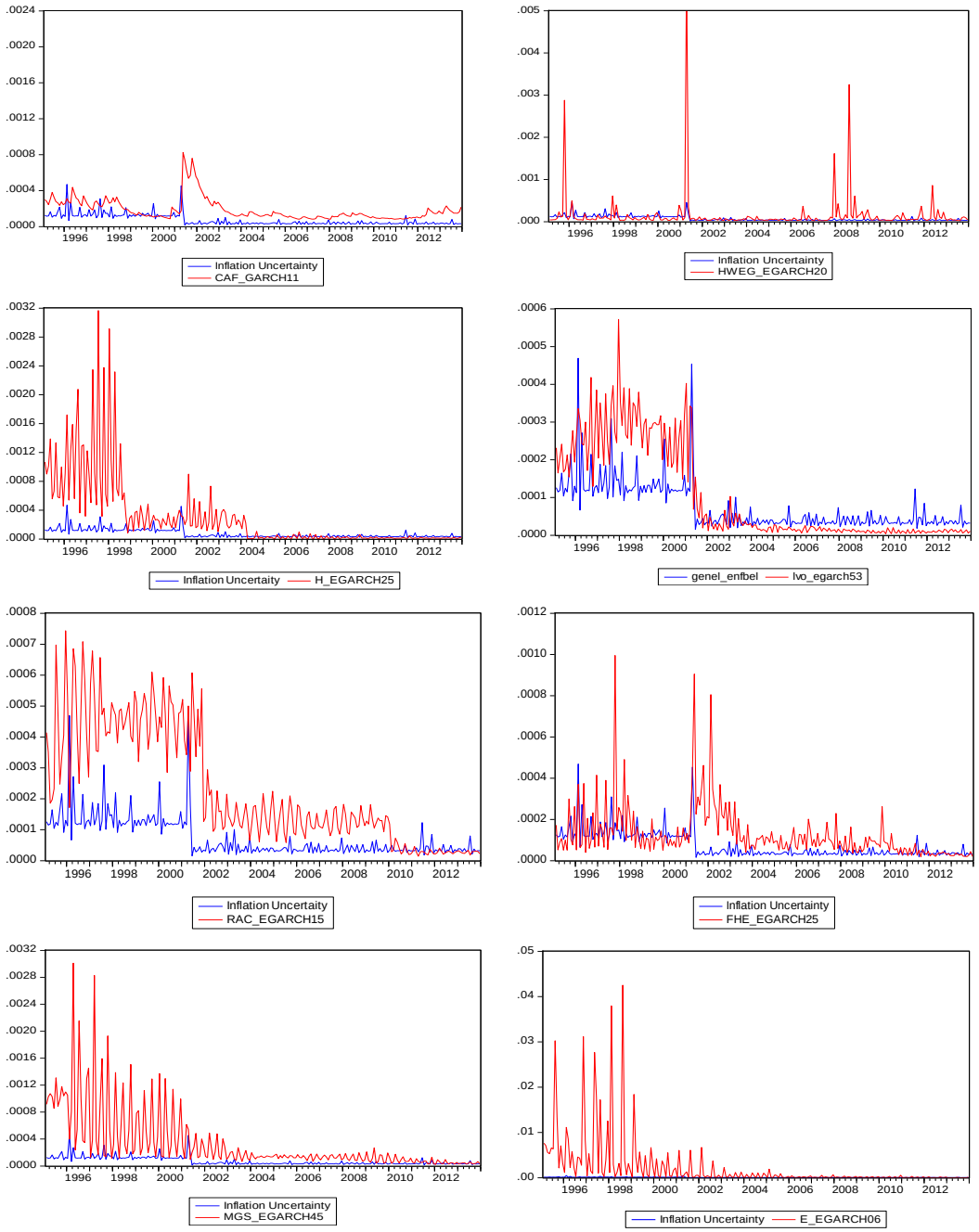


Figure 3: Plotting of Inflation Uncertainty with the Uncertainty For Each of The Main Expenditure Groups

4.5.1. Investigation of the co-integration relationship between the variables

ARDL methodology is performed across the stages presented below. In its basic form, ARDL model is as follows;

$$Y_t = \varphi + \sum_{i=1}^{p} \gamma_{0i} Y_{t-i} + \sum_{i=0}^{q_1} \gamma_{1i} X1_{t-i} + \sum_{i=0}^{q_2} \gamma_{2i} X2_{t-i} + \sum_{i=0}^{q_3} \gamma_{3i} X3_{t-i} + \sum_{i=0}^{q_4} \gamma_{4i} X4_{t-i} + \sum_{i=0}^{q_5} \gamma_{5i} X5_{t-i} + \sum_{i=0}^{q_6} \gamma_{6i} X6_{t-i} + \sum_{i=0}^{q_7} \gamma_{7i} X7_{t-i} + \sum_{i=0}^{q_8} \gamma_{8i} X8_{t-i} + \sum_{i=0}^{q_9} \gamma_{9i} X9_{t-i} + \sum_{i=0}^{q_{10}} \gamma_{10i} X10_{t-i} + \varepsilon_t \quad (7)$$

since the lag of the dependent variable Y_t is added to the first part of the model, it represents autogressive term and successive lags of the independent variable $\mathbf{X_t}$ in the second part represent distributed lag and $\boldsymbol{\varepsilon_t}$ represents white noise error term.

As known, though the bound test approach allows the series to be integrated at different levels, as it is based on the assumption that the variables are I(0) and I(1) and when the variables have greater integration level order, the t and F statistics in Pesaran et al. (2001) become invalid. Thus, in order to test the constraint, unit root tests were implemented and the obtained results are presented in Appendix 5. It can be seen that while some of the series are stationary at the level, some others are not stationary and when the first difference of all is considered, they become stationary. In such cases, co-integration analysis is suggested to prevent the problem of losing the long run relationship when the first differences are used (Gujarati, 2004).

For the variables between which long run relationship is investigated, when the Unrestricted Error Correction Model $ARDL\ (p, q_1, q_2, \cdots, q_{10})$ appearance in the Eq. 8 is considered;

$$\Delta(Y_t) = \omega + \sum_{i=1}^{p} \varphi_i \Delta(Y_{t-i}) + \sum_{i=0}^{q_1} \alpha_{1i} \Delta(X1_{t-i}) + \sum_{i=0}^{q_2} \alpha_{2i} \Delta(X2_{t-i}) + \sum_{i=0}^{q_3} \alpha_{3i} \Delta(X3_{t-i}) + \sum_{i=0}^{q_4} \alpha_{4i} \Delta(X4_{t-i}) + \sum_{i=0}^{q_5} \alpha_{5i} \Delta(X5_{t-i}) + \sum_{i=0}^{q_6} \alpha_{6i} \Delta(X6_{t-i}) + \sum_{i=0}^{q_7} \alpha_{7i} \Delta(X7_{t-i}) + \sum_{i=0}^{q_8} \alpha_{8i} \Delta(X8_{t-i}) + \sum_{i=0}^{q_9} \alpha_{9i} \Delta(X9_{t-i}) + \sum_{i=0}^{q_{10}} \alpha_{10i} \Delta(X10_{t-i}) + \beta_0 Y_{t-1} + \beta_1 X1_{t-1} + \beta_2 X2_{t-1} + \beta_3 X3_{t-1} + \beta_4 X4_{t-1} + \beta_5 X5_{t-1} + \beta_6 X6_{t-1} + \beta_7 X7_{t-1} + \beta_8 X8_{t-1} + \beta_9 X9_{t-1} + \beta_{10} X10_{t-1} + \varepsilon_t \quad (8)$$

In the equation, "Δ" represents difference operator, $\beta_0 \cdots \beta_{10}$ coefficients represent long run relationships and the remaining terms represent short run dynamics. Null hypothesis $H_0: \beta_0=\beta_1=...=\beta_{10}=0$ showing the absence of co-integration is tested with F-test shown as $F(Y_t|X_1, X_2, ..., X_{10})$ versus alternative hypothesis $H_1: \beta_0 \neq \beta_1 \neq ... \neq \beta_{10} \neq 0$. For the dependent variable, in the testing of $H_0: \beta_0=0$ ve $H_1: \beta_0 \neq 0$ hypothesis, t-test is run. The calculated test statistics must be compared with the critical values presented in Pesaran (2001).

As the variables used in the study are monthly series, maximum lag length is considered as 12. In this case, in order to be able to find the suitable lag length, $(12+1)^{10}$ different regressions will be estimated. Selection of the suitable criteria can be performed by using SBC and AIC criteria. In this connection, to determine the optimum lag lenght of the model presented in Eq. (5), every single model with SBC and AIC up to 12 lag lenght has been performed. As a result of the model searching, OLS estimates obtained from ARDL resulted in $(1,1,6,0,3,3,0,1,0,0,1)$ model having the lowest AIC and SBC values are presented in Appendix 6.

For ARDL bound test approach, by using the coefficients in Table 5 must be tested. As known, if both of the hypotheses are rejected, then it can be claimed that the independent variables have a co-integration relationship with the dependent variable in the long run. For the testing of the first established hypothesis, Wald t statistics and for the second hypothesis, Wald F statistics must be calculated. The calculated test statistics are compared with the critical values presented in Pesaran (2001).

Table 5: ARDL Bound Test Co-integration Results

Hypothesis [2]	k[1] Test statistic	Lower Bound I(0)[3]			Upper Bound I(1)[4]		
		%1	%5	%10	%1	%5	%10

1		10	-9.151678	-3.43	-2.86	-2.57	-5.68	-5.03	-4.69
2		10	9.840998	2.54	2.06	1.83	3.86	3.24	2.94

Note: [1] *"k" represents (The number of parameters-1)*

[2] *Critical values for the calculated t statistics of the first hypothesis have been obtained from the study of Pesaran (2001), page 303 of Table CII(iii) for the Case III and Critical values for the calculated F statistics of the second hypothesis have also been obtained from the study of Pesaran (2001), page 300 of Table CI(iii) for the Case III*

[3, 4] *The percentage results represent the significance levels.*

According to Wald t or F statistical values, both in the first and the second hypotheses, it is seen that the null hypothesis was rejected. Thus, it was proved that there is a long run co-integration between the main expenditure group uncertainty series and inflation uncertainty and these variables are not independent from each other and act simultaneously.

When a cointegreation is detected between the variables, from the long run regression equation, which is the normalized version of the Eq. 4, the ARDL model can be given below;

$$Y_t = \theta_0 + \theta_1 X1_t + \theta_2 X2_t + \theta_3 X3_t + \theta_4 X4_t + \theta_5 X5_t + \theta_6 X6_t + \theta_7 X7_t + \theta_8 X8_t + \theta_9 X9_t + \theta_{10} X10_t + v_t \quad (9)$$

From Eq. 6, the obtained residual series with one-lag that is used as an error correction term (ECT) may be presented in Eq. 7.

$$ECT_{t-1} = (Y_{t-1} - \theta_0 - \theta_1 X1_{t-1} - \theta_2 X2_{t-1} - \theta_3 X3_{t-1} - \theta_4 X4_{t-1} - \theta_5 X5_{t-1} - \theta_6 X6_{t-1} - \theta_7 X7_{t-1} - \theta_8 X8_{t-1} - \theta_9 X9_{t-1} - \theta_{10} X10_{t-1}) \quad (10)$$

Following the Eq. 7, the given term is incorporated into the short run ARDL model as follows:

$$\begin{aligned} \Delta(Y_t) = \omega &+ \sum_{i=1}^{p} \varphi_i \, \Delta(Y_{t-i}) + \sum_{i=0}^{q_1} \alpha_{1i} \, \Delta(X1_{t-i}) + \sum_{i=0}^{q_2} \alpha_{2i} \, \Delta(X2_{t-i}) + \sum_{i=0}^{q_3} \alpha_{3i} \, \Delta(X3_{t-i}) + \sum_{i=0}^{q_4} \alpha_{4i} \, \Delta(X4_{t-i}) \\ &+ \sum_{i=0}^{q_5} \alpha_{5i} \, \Delta(X5_{t-i}) + \sum_{i=0}^{q_6} \alpha_{6i} \, \Delta(X6_{t-i}) + \sum_{i=0}^{q_7} \alpha_{7i} \, \Delta(X7_{t-i}) + \sum_{i=0}^{q_8} \alpha_{8i} \, \Delta(X8_{t-i}) \\ &+ \sum_{i=0}^{q_9} \alpha_{9i} \, \Delta(X9_{t-i}) + \sum_{i=0}^{q_{10}} \alpha_{10i} \, \Delta(X10_{t-i}) + \beta(ECT_{t-1}) + e_t \end{aligned} \quad (11)$$

In light of the above, as a result of model searching conducted by using AIC and SBC information criteria on the Eq. (7), ARDL(2,0,0,0,0,0,0,1,0,0,0) was obtained. The estimated results of the model are shown in Appendix 7. By including one lag of the residuals of this model into the Eq. (8), the re-estimation was conducted. After normalization was administered to the model, the obtained long run co-integration results are presented in Table 6.

Table 6: Parameter Estimates of Long Run Co-integration Equation

Dependent Variable Y_t

Variable	Coefficient	Standardized Coefficient	Test Statistic	P-value
θ_0	0.0000108	---	2.412396	0.0167
$X1_t$	0.1623479	0.3558991	7.014110	0.0000
$X2_t$	-0.1704214	-0.3253826	-7.912309	0.0000
$X3_t$	0.0119463	0.0841174	2.244549	0.0258
$X4_t$	0.0835068	0.1668403	2.503045	0.0131
$X5_t$	0.0354218	0.2725039	9.526206	0.0000
$X6_t$	0.1269189	0.4512709	8.889989	0.0000
$X7_t$	0.0291217	0.2290639	9.361180	0.0001
$X8_t$	-0.0691100	-0.2043759	-3.599195	0.0004
$X9_t$	0.0391511	0.0777966	2.182651	0.0302

$X10_t$	0.0003455	0.0303646	0.844175	0.3995
Short-Term Error Correction Term				
ECT_{t-1}	-0.854599 (0.0000)			

It is seen that the error correction term (ECT) coefficient in the model is negative and significant as expected. As known, a coefficient of this term shows how much of the volatility occurring in the short run will reach equilibrium in the long run. It indicates that nearly 85% of the uncertainty that will be experienced in the long run will reach equilibrium one period later.

When the coefficients belonging to the main expenditure group inflation uncertainties are examined, it is notable that the long run coefficients of the "clothing and footwear" and "recreation and culture" sub-groups are negative. This finding shows that customers' reactions to the price increases and decreases in these groups, which are not considered to be primary needs by the customers, are in the reverse direction in response to price changes in the economy. For instance, when uncertainty increases in the inflation, the price changes in the expenditure groups viewed to be less important by consumers seem to decrease. Uncertainties experienced in the other expenditure groups move in the same direction with inflation uncertainty.

After this stage, relative weights of the main expenditure groups on inflation uncertainty that is the main focus of the study will be determined. Following the standardization of all the variables (dependent and independent variables), regression model was estimated with the standardized variables. In this regard, the main expenditure groups and uncertainty relative weights calculated for the period of 1994-2013 are reported in Table 7.

Table 7: Relative Weights of the Main Expenditure Groups Uncertainties on Inflation Uncertainty For The Period of 1994-2013

MEG Uncertainties	Relative Weight(*)
Transportation	20.53
Food, Beverages, Tobacco	16.19
Clothing and Footwear	14.81
Housing	12.40
Health	10.42
Recreation and Culture	9.30
Hotels, Cafes, Restaurants	7.59
Miscellaneous Goods	3.83
Furnishings, Household	3.54
Education	1.38

(*) *Relative weights are obtained from the absolute standardized coefficients as contribution to uncertainty of inflation in percentages.*

When the weights of expenditure groups uncertainties between the years of 1994 and 2013 are considered, it is seen that the "transportation" has the highest relative importance on price instability different from the expectation. The uncertainty of "food, beverages, tobacco" main expenditure group is in the second order in terms of relative importance. Besides, it is clearly observed from Figure 3 that in the long run, price fluctuations in the sectors moving most obviously together with inflation uncertainty are in fact "transportation" and "food, beverage and tobacco" uncertainties.

5. RESULTS AND FINDINGS

Changes taking place in price movements should be comprehensively addressed to enhance the efficiency and permanency of the economic policy to be implemented in disinflation. In addition to this, in the international literature, the phenomenon of inflation is generally explained over the general level of prices and mostly the changes taking place at lower levels are overlooked.

In Turkey, as the general level of prices, Consumer Price Index (CPI) is used and inflation is calculated on the basis of the value changes in this index. Therefore, CPI was used for the analysis of inflation uncertainty in the present study; however, while doing this, the measurements considering not only the price changes in CPI but also price fluctuations experienced in all the lower levels.

From the long run established by using the standardized uncertainty series determined to have co-integration between them through ARDL approach, relative weights of the main expenditure group inflation uncertainties within inflation uncertainty were determined. It was observed that long run inflation uncertainty and "clothing and footwear" and "recreation and culture" sub-groups price uncertainties move in reverse direction and the uncertainties experienced in the other main expenditure group move in the same direction. Moreover, the average weight of the main group expenditure groups CPI in 1994-2013 is presented in Table 8.

Table 8: The Average Weight of The Main Group Expenditure Groups in CPI in 1994-2013

MEG	Average Weight (*)
Food, Beverages, Tobacco	32.07
Housing	20.87
Transportation	11.30
Clothing and Footwear	8.57
Furnishings, Household	8.05
Miscellaneous Goods	6.88
Hotels, Cafes, Restaurants	4.64
Recreation and Culture	3.05
Health	2.63
Education	1.95

(*) *It states that average weight of main expenditure groups of CPI for the period of 1994-2013 in percentages.*

Source: Turkish Statistical Institute

The sectors having the highest mean weight in the investigated period and explaining nearly 64% of the index are food, beverage, tobacco, housing and transportation and these main groups are expected to have a strong effect on inflation. That is, in the last 20 years, consumers spend 64% of their expenditures on these groups.

On the other hand, within fluctuations seen in the general level of prices, the weight of these groups in inflation uncertainty corresponds to only 49.1% (See Tab. 7). Therefore, almost half of the price fluctuations experienced in the last twenty years have resulted from the volatilities in these three main expenditure groups.

Moreover, in Figure 3, it is illustrated that there is a parallelism between one expenditure group uncertainty and inflation uncertainty. It is clearly seen that in the long run, price fluctuations in the sectors moving most obviously together with inflation uncertainty are in "transportation" and "food, beverage and tobacco". In addition, the sector moving together most obviously with inflation uncertainty in the long run and giving the fastest response to changes in inflation uncertainty is transportation.

Thus, when the weight of an expenditure group is high on CPI; that is, it constitutes a great portion of the consumption pattern of a citizen and when some changes occur in this group that does not mean that it would create a change at the same ratio in general inflation.

In this regard, contribution to inflation and contribution to inflation uncertainty are different things. As stated before, as most of the groups having greater weight in consumption are required and cannot be substituted, sensitivity to increasing prices is restricted due to reasons such as deeply-rooted consumption patterns. Therefore, price changes taking place in these groups do not lead to uncertainty as large as expected.

As known, in recent years, it has been emphasized by both CBRT and economic circles that high inflation figures have resulted from the negative direction of food prices and failure in achieving the inflation targets has been explained by the increases in food prices. However, the present study also revealed that this assumption made on the basis of the high ratio of foods in CPI may not be true. However, after 2001 Turkey has made a fair success in terms of price stability and managed to keep inflation below 10%. This is why the study should be reperformed for the period after 2002 to check if there is a difference in the sources of price instability.

In the meanwhile, one of the most outstanding outcomes of the current study is revelation of the relative importance of the transportation main expenditure group in price uncertainties. It has been ignored for years that oil prices have been a key role in affecting inflation. For CPI inflation, there is a direct relationship between changes in oil prices and inflation itself. Shocks occurring in oil prices speed up CPI inflation in proportion to the weight of automotive fuel within the CPI (Norman and Richards, 2012, p. 71).

It is clear that liquid fuel which is itself a cost and the large consumption proportion of it has a significant role on price instability in developing countries like Turkey.

Moreover in most of non-oil producing countries such as Turkey, these developments become even more obvious.

As a conclusion, in countries like Turkey implementing inflation targeting and experiencing some difficulties in achieving the target, policies for solutions should be created considering price movements particularly in sectors having relatively higher importance in price uncertainties.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests regarding the publication of this paper.

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APPENDIX

Appendix 1: Unit Root Examination of the Inflation Series belonging to Inflation and the Main Expenditure Groups (1994:01-2013:12)[1,2]

Method	M	INFLATION	FBT_INF	CAF_INF	HWEG_INF	FHE_INF	H_INF	T_INF	RAC_INE_INF	HAR_INF	MGS_INF
ADF[)]	N	-2.194	-2.470	-3.591	-2.198	-4.500	**-1.799**	-2.867	-2.776	**-1.531**	-2.419	-2.540
	I	**-1.871**	**-2.677**	**-2.632**	**-2.620**	-5.120	**-1.199**	-4.632	-3.130	**-1.430**	-2.889	**-2.339**
	IT	-7.911	-8.902	**-1.623**	-7.051	-9.289	**-1.460**	-9.862	-10.704	**-2.625**	-6.500	-13.904
PP[)]	N	-4.584	-6.809	-9.626	-3.152	-4.304	-10.050	-7.332	-5.871	-11.453	-2.706	-10.110
	I	-5.756	-8.269	-9.017	-5.462	-6.704	-12.278	-10.106	-8.085	-11.985	-5.925	-12.498
	IT	-9.831	-8.948	-8.530	-11.324	-10.612	-15.565	-12.309	-10.950	-15.265	-12.061	-14.163
KPSS	I	**2.012**	**2.178**	**0.496**	**1.886**	**1.735**	**2.185**	**1.885**	**1.880**	**1.391**	**1.912**	**2.024**
	IT	**0.459**	**0.233**	**0.182**	**0.329**	**0.297**	**0.213**	**0.279**	**0.341**	0.109	**0.472**	**0.266**

[1] *Bold values refers to existance of unit root.*

[2] *N, I and IT represent "None", "Intercept" and "Intercept and Trend" components respectively.*

Appendix 2: The Mean Equations with Structural Breaks of Inflation and Main Expenditure Groups Series

Dependent Var.	Mean Equation
INFLATION	0.0169298993153*D1+0.460244976123*D1*INF(-1) +0.0935416263364*D1* INF(-5) + 0.444756240424*D2*INF(-1) + 0.129792604227*D2* INF(-5) + 0.0113324816663*@SEAS(1) + 0.00856340452899*@SEAS(4) - 0.00963173113866*@SEAS(6) + 0.0124226359211*@SEAS(9) + 0.0137850863729* @SEAS(10)
FBT_INF	0.016*D1 + 0.489*D1*FBT_INF(-1) - 0.282*D1*FBT_INF(-4) + 0.270*D1* FBT_INF(-5) + 0.006*D2 - 0.134*D2*FBT_INF(-4) - 0.190*D2*FBT_INF(-12) + 0.024*@SEAS(1) +0.0171* @SEAS(2) + 0.013*@SEAS(3) - 0.014*@SEAS(5) - 0.031*@SEAS(6) + 0.010*@SEAS(9) + 0.022*@SEAS(10) + 0.012*@SEAS(11)
CAF_INF	0.014*D1 + 0.170*D1*CAF_INF(-1) + 0.161*D1*CAF_INF(-4) + 0.197*D1*GV A_ENF(-5) - 0.169*D1*CAF_INF(-10) + 0.098*D1*CAF_INF(-11) + 0.256*D1* CAF_INF(-12) + 0.005* D2 + 0.563*D2*CAF_INF(-1) - 0.399*D2*CAF_INF(-2) - 0.321*D2*CAF_INF(-3) + 0.180* D2*CAF_INF(-4) - 0.229*D2*CAF_INF(-6) + 0.253*D2*CAF_INF(-7) + 0.288 *D2*GVA_ ENF (-11) - 0.203*D2*CAF_INF(-12) + 0.007*D3 +0.244*D3*CAF_INF(-1) - 0.374*D3*GVA _ENF(-2) + 0.197*D3*GV A_ENF(-3) - 0.321*D3*CAF_INF(-4) + 0.257*D3 *CAF_INF(-10) + 0.439*D3*G VA_ENF(-12) - 0.044*@SEAS(1) - 0.043*@SEAS(2) - 0.034*@SEAS(3) + 0.048* @SEAS(4) + 0.020*@SEAS(5) - 0.018*@SEAS(7) - 0.024*@ SEAS(8) +0.041*@ SEAS(10)
HWEG_INF	0.061*D1 - 0.176*D1*HWEG_INF(-3) - 0.195*D1*HWEG_INF(-8) + 0.089*D1*KS EG_ENF (-11) - 0.002*D2 + 0.392*D2*HWEG_INF(-1) + 0.173*D2*HWEG_INF(-4) + 0.202*D2* HWEG_INF(-6) + 0.012*@SEAS(1) + 0.005*@SEAS(6) + 0.005*@ SEAS(7) + 0.007*@SEAS(8) + 0.014*@SEAS(9) + 0.012*@SEAS(10) + 0.005*@SEAS(11)
FHE_INF	0.025*D1 - 0.312*D1*FHE_INF(-1) + 0.170*D1*FHE_INF(-2) + 0.212*D1* MO BILYA_ ENF(-3) + 0.322*D1*FHE_INF(-4) + 0.449*D2* MO BILYA_ENF(-1) + 0.207* D2* FHE_INF(-2) + 0.145*D2*FHE_INF(-9) + 0.0124*@SEAS(1) + 0.005*@SEAS(9) + 0.005*@SEAS(10)
T_INF	0.031*D1 + 0.473*D1*T_INF(-1) + 0.212*D1*T_INF(-3) - 0.253*D1*T_INF(-4)+0.185*D1 *U _ENF(-5) - 0.241*D1*T_INF(-6) - 0.078*D1*T_INF(-11) + 0.353*D2*T_INF(-1) + 0.178* D2* T_INF(-5) + 0.125*D2*T_INF(-9) + 0.019*@SEAS(1) + 0.009*@SEAS(4) + 0.010*@SEAS(7)
H_INF	0.0233*D1 - 0.279*D1*H_INF(-1) + 0.364*D1*H_INF(-6) + 0.278*D1*H_INF(-7) - 0.232* D1*H_INF(-9) + 0.362*D1*H_INF(-12) + 0.325*D2*H_INF(-1) - 0.156*D2*H_INF(-2) + 0.213*D2*H_INF(-3) + 0.132*D2*H_INF(-4) + 0.266*D2*H_INF(-6) - 0.195*D2*H_INF (-9) + 0.167*D2*H_INF(-12) + 0.0145*@SEAS(1) + 0.008*@SEAS(3) + 0.0010*@SEAS(4)
RAC_INF	0.065*D1 + 0.514*D1*RAC_INF(-1) - 0.234*D1*RAC_INF(-2) - 0.230*D1*RAC_INF(-4) + 0.176*D1*RAC_INF(-5) - 0.191*D1*RAC_INF(-6) - 0.160*D1*RAC_INF(-8) - 0.337*D1*RAC_INF(-10) + 0.274*D1*RAC_INF(-11) - 0.092*D1*RAC_INF(-12) + 0.344*D2*RAC_INF(-1) + 0.245*D2*RAC_INF(-4) + 0.148*D2* RAC_INF(-5) + 0.134*D2*RAC_INF(-8) + 0.012*@SEAS(1) - 0.010*@SEAS(2)

E_INF	0.242*D1 - 0.236*D1*E_INF(-1) - 0.370*D1*E_INF(-2) - 0.339*D1*E_INF(-3) - 0.388*D1*E_INF(-4) - 0.370*D1*E_INF(-5) - 0.362*D1*E_INF(-6) - 0.407*D1*E_INF(-7) - 0.344*D1*E_INF(-8) - 0.399*D1*E_INF(-9) - 0.328* D1*E_INF(-10) - 0.416*D1*E_INF(-11) + 0.248*D1*E_INF(-12) - 0.106*D2 *E_INF(-1) + 0.282*D2*E_INF(-11) + 0.499*D2*E_INF(-12) - 0.0419*@ SEAS(7) + 0.0302*@SEAS(8) + 0.051*@SEAS(9)
HAR_INF	0.223*D1*HAR_INF(-1) + 0.404*D1*HAR_INF(-3) + 0.136*D1*HAR_INF(-7) + 0.131*D1*HAR_INF(-11) + 0.637*D2*HAR_INF(-1) + 0.013*@SEAS(1) + 0.006* @SEAS(2) + 0.005*@SEAS(4) + 0.005*@SEAS(8) + 0.006*@SEAS(9) + 0.006* @SEAS(10)
MGS_INF	0.0353*D1 + 0.108*D1*MGS_INF(-12) + 0.267*D2*MGS_INF(-6) + 0.216* D2*MGS_INF(-9) + 0.033*@SEAS(1)

Appendix 3: Stationarity and ARCH Effect Diagnosis of the Residuals Obteained From Mean Equations of Inflation Itself and Inflation From Expenditures

Variables	Breusch-Godfrey Serial Correlation LM Test		Breusch-Pagan-Godfrey Heteroskedasticity Test	
	F-statistic	Obs*R-squared	F-statistic	Obs*R-squared
FBT_INF	0.138188 (0.9974)	1.134861 (0.9972)	2.647475 (0.0045)	24.83254 (0.0057)
CAF_INF	0.433048 (0.5112)	0.464932 (0.4953)	2.231025 (0.0078)	29.14966 (0.0100)
HWEG_INF	0.431408 (0.9568)	6.749883 (0.9146)	2.177953 (0.0009)	56.75343 (0.0022)
FHE_INF	0.085028 (0.3736)	0.091408 (0.3565)	2.198205 (0.0192)	20.92778 (0.0216)
H_INF	1.656097 (0.1995)	1.661407 (0.1974)	3.068080 (0.0008)	30.83328 (0.0012)
T_INF	1.812861 (0.1459)	5.148086 (0.1613)	7.448952 (0.0000)	82.18703 (0.0000)
RAC_INF	1.034498 (0.3103)	1.039639 (0.3079)	3.326678 (0.0001)	38.33001 (0.0003)
FBT_INF	0.397118 (0.6720)	0.179321 (0.5293)	2.012893 (0.0137)	30.18430 (0.0171)
RAC_INF	0.651194 (0.4206)	0.648137 (0.4208)	4.191362 (0.0000)	40.10583 (0.0000)
E_INF	2.843228 (0.0605)	6.095640 (0.0475)	5.938328 (0.0000)	80.08051 (0.0000)
MGS_INF	1.637566 (0.1816)	4.979899 (0.1733)	4.656691 (0.0005)	21.63611 (0.0006)

[*] *Values between brackets represent the significant p level..*

Appendix 4 Definitions of Uncertainty Series to be Used in the Modeling of Inflation Uncertainty

Variable Names	Description
Inflation Uncertainty	Y
Uncertainty of Food, Beverages and Tobacco Inflation	X1
Uncertainty of Clothing and Footwear Inflation	X2
Uncertainty of Miscellaneous Goods and Services Inflation	X3
Uncertainty of Hotels, Cafes and Restaurants Inflation	X4
Uncertainty of Housing Inflation	X5
Uncertainty of Transportation Inflation	X6
Uncertainty of Health Inflation	X7
Uncertainty of Recreation and Culture Inflation	X8
Uncertainty of Furnishings, Household Equipment Inflation	X9
Uncertainty of Education Inflation	X10

Appendix 5: Unit Root Detection For the Inflation Uncertainty and The Uncertainty of Main Sub-Groups[1]

Method	ADF		PP		KPSS	
Variable	Level	DI[2]	Düzey	DI	DI	Decision
Y	**-1.9918**	I(1)	-11.047	I(0)	**1.51445**	I(1)
X1	**-1.7778**	I(1)	-5.2389	I(0)	**1.47829**	I(1)
X2	-3.5473	I(0)	-3.4918	I(0)	**0.68516**	I(1)
X3	**-2.6266**	I(1)	-13.7496	I(0)	**1.49149**	I(1)
X4	**-1.1551**	I(1)	**-2.7606**	I(1)	**1.51407**	I(1)
X5	-14.598	I(0)	-14.6001	I(0)	0.066064	I(0)
X6	**-2.1142**	I(1)	-7.0713	I(0)	**1.51436**	I(1)
X7	**-1.7599**	I(1)	-11.1607	I(0)	**1.39955**	I(1)
X8	**-1.0643**	I(1)	-4.2359	I(0)	**1.6931**	I(1)
X9	**-2.612**	I(1)	-12.8693	I(0)	**0.9351**	I(1)
X10	**-1.2908**	I(1)	-13.0916	I(0)	**1.75658**	I(1)

(1) *Bold values refer to existence of unit root.*

(2) *"DI" refers the degree of integration.*

Appendix 6: The Results of Unrestricted Error Correction Model From ARDL (1,1,6,0,3,3,0,1,0,0,1)

Dependent Variable $\Delta(Y_t)$				
Variable	Coefficient	St. Error	t-statistic	p-value
ω	1.52E-05	5.06E-06	3.003666	0.0030
$\Delta(Y_{t-1})$	-0.266716	0.060367	-4.418204	0.0000
$\Delta(X1_t)$	0.193240	0.022770	8.486507	0.0000
$\Delta(X1_{t-1})$	0.061676	0.024174	2.551360	0.0116
$\Delta(X2_t)$	0.153193	0.048666	3.147859	0.0019
$\Delta(X2_{t-1})$	0.006866	0.048381	0.141920	0.8873
$\Delta(X2_{t-2})$	-0.023621	0.044709	-0.528325	0.5979
$\Delta(X2_{t-3})$	-0.066901	0.041555	-1.609952	0.1091
$\Delta(X2_{t-4})$	-0.129474	0.032770	-3.951051	0.0001
$\Delta(X2_{t-5})$	-0.099750	0.032667	-3.053558	0.0026
$\Delta(X2_{t-6})$	-0.082574	0.032672	-2.527353	0.0123
$\Delta(X3_t)$	0.005547	0.005284	1.049938	0.2951
$\Delta(X4_t)$	0.107413	0.050777	2.115368	0.0358
$\Delta(X4_{t-1})$	0.122278	0.065447	1.868352	0.0633
$\Delta(X4_{t-2})$	0.126543	0.062950	2.010217	0.0459
$\Delta(X4_{t-3})$	0.140320	0.050540	2.776398	0.0061
$\Delta(X5_t)$	0.033386	0.003268	10.21492	0.0000

$\Delta(X5_{t-1})$	-0.013157	0.007402	-1.777498	0.0772
$\Delta(X5_{t-2})$	-0.020481	0.005928	-3.455112	0.0007
$\Delta(X5_{t-3})$	-0.018753	0.004205	-4.460271	0.0000
$\Delta(X6_t)$	0.100189	0.014146	7.082700	0.0000
$\Delta(X7_t)$	0.008502	0.005415	1.569896	0.1182
$\Delta(X7_{t-1})$	0.009537	0.005481	1.739913	0.0836
$\Delta(X8_t)$	-0.032877	0.021724	-1.513370	0.1319
$\Delta(X9_t)$	0.004197	0.017266	0.243073	0.8082
$\Delta(X10_t)$	8.98E-05	0.000411	0.218812	0.8270
$\Delta(X10_{t-1})$	-0.000544	0.000374	-1.455296	0.1473
Y_{t-1}	-0.970326	0.106027	-9.151678	0.0000
$X1_{t-1}$	0.086155	0.034592	2.490628	0.0136
$X2_{t-1}$	-0.080956	0.028931	-2.798262	0.0057
$X3_{t-1}$	0.010765	0.007788	1.382164	0.1686
$X4_{t-1}$	0.131180	0.049658	2.641659	0.0090
$X5_{t-1}$	0.038277	0.009095	4.208751	0.0000
$X6_{t-1}$	0.113761	0.019349	5.879378	0.0000
$X7_{t-1}$	0.016417	0.008539	1.922515	0.0561
$X8_{t-1}$	-0.039576	0.023778	-1.664412	0.0978
$X9_{t-1}$	-0.018655	0.025378	-0.735090	0.4632
$X10_{t-1}$	0.000797	0.000657	1.212895	0.2267

R-square	0.906851	Akaike İnformation Criterion	-18.46312
Adjusted R-square	0.887914	Schwarz Bayesian Criterion	-17.87695
St. Error of Reg.	2.19E-05	Durbin-Watson statistic	2.128172
F-statistic	47.88790	Probability(F-stat)	0.000000
Breusch-Godfrey Autocorrelation LM(2) Testi	6.382787 (0.0411)	ARCH Heteroscedasticity $\chi^2_{ARCH(1)}$ test	0.003674 (0.9517)
Breusch-Godfrey Autocorrelation LM(12) Testi	16.80622 (0.1570)	Ramsey-Reset F(1,181) test	13.49654 (0.0003)

Appendix 7 The Estimated Results of ARDL(2,0,0,0,0,0,0,1,0,0,0) Model

Dependent Variable Y_t

Variable	Coefficient	Standard Error	t-statistic	p-value
φ	1.04E-05	4.31E-06	2.412396	0.0167
Y_{t-1}	-0.140160	0.039564	-3.542628	0.0005
Y_{t-2}	0.179113	0.042725	4.192201	0.0000
$X1_t$	0.156024	0.022244	7.014110	0.0000
$X2_t$	-0.163783	0.020700	-7.912309	0.0000
$X3_t$	0.011481	0.005115	2.244549	0.0258

$X4_t$	0.080254	0.032063	2.503045	0.0131
$X5_t$	0.034042	0.003574	9.526206	0.0000
$X6_t$	0.121975	0.013720	8.889989	0.0000
$X7_t$	0.013368	0.004542	2.943619	0.0036
$X7_{t-1}$	0.015140	0.005473	2.766375	0.0062
$X8_t$	-0.066418	0.018454	-3.599195	0.0004
$X9_t$	0.037626	0.017239	2.182651	0.0302
$X10_t$	0.000332	0.000394	0.844175	0.3995

R-square	.852720	Akaike İnformation Criterion	-18.25092
Adjusted R-square	.843646	Schwarz Bayesian Criterion	-18.03836
St. Error of Reg.	.56E-05	Durbin-Watson istatistiği	1.925516
F-statistic	3.97287	Olasılık(F-istatistiği)	0.000000
Breusch-Godfrey Serisel Autocorrelation LM(2) Testi	.692767 (0.1578)	ARCH Heteroscedasticity $\chi^2_{ARCH(1)}$ testi	0.008354 (0.9272)
Breusch-Godfrey Serisel Autocorrelation LM(12) Testi	.640282 (0.7333)	Ramsey-Reset F(1,210) test	15.72869 (0.0001)